M14 to MK 14 – Evolution of a Battle Rifle 06/04/07

Slide (1) Opening Slide - Intro

Slide (2) all weapons the M14 was to replace (with M14 too)

The first US weapon chambered in the new 7.62mm NATO caliber adopted in 1953 was the M14 Rifle. It had a rather rocky start after slowly evolving from the venerable M1 Garand of World War 2 fame. The T44E4 adopted in final form as the M14 Rifle in May of 1957 embodied the excellent features of the M1 along with various improvements to include a detachable 20 round magazine. It retained true battle rifle capability using a half inch shorter cartridge of equal performance to the original .30 caliber round. If it had simply been intended to replace the M1 rifle it no doubt would have been considered solid in that role. It was about the same weight with a high capacity detachable magazine and improved gas system while retaining the Garand's excellent sights. However, it was envisioned to replace 5 weapon classes in the U.S. inventory – the M1 Garand, BAR, M1 & M2 Carbines, and even the M3A1 "Grease Gun" along with sniper rifles. This was a tall order for any single weapon design – and would of course involve "compromise".

Slide (3) of M14 stripped and A1 and M21 forms

Being chambered for a full power rifle cartridge the M14 had nowhere near the controllability of a sub-gun such as the Thompson or the slow firing M3A1 "Grease Gun". It was over 6 lbs lighter in weight than the old 16 pound BAR, and combined with the high 750 shot per minute rate of fire - controllability was a challenge. The BAR was selectable between two firing rates of about 400 and 600 shots per minute. The M15 which had originally been intended to be the Squad Automatic Weapon type BAR replacement, never came into being. An adjustable rate of fire had been experimented with for the M15, and it would have had a heavier barrel. Final form M14 barrels were hard chrome lined to resist auto fire erosion / corrosion and to ease cleaning. A well built bipod was also available – still in use today in modified form on Navy .50 caliber Special Application Sniper Rifles. Government M14 production at Springfield Armory was not initiated until a full year after adoption with 2 production contracts later awarded in 1959 to Winchester and Harrington & Richardson. The transition to production was not smooth or fast. TRW would not have a production contract until 1961.

Slide (4) of M16 and XM177 with AK47 / M14 and FG 42

The M14 was not given much opportunity to shine as the true battle rifle it is in Viet Nam's jungle terrain, which favored lighter quick handling weapons used at relatively close range. The Jungle was the ideal environment for a light weight assault rifle and cartridge combination such as the AR-15 system. The previous assault cartridges and weapons were heavy compared to this new combination. This Gene Stoner conceived AR-15 design was then owned by Colt. Fairchild – Armalite's parent firm, had transferred the entire package including Mr. Stoner's services to Colt's Patent Firearms by late 1959.

The .223 caliber ammunition was about half the weight of the 7.62mm NATO cartridge allowing for a double basic load. A loaded M16 was nearly 4 pounds lighter than a loaded M14 (both with 20 rounds at the ready). Its intermediate power round and lower recoil allowed for a heavy volume of relatively controllable firepower for close range guerilla style fighting. The M16 as it would be known by 1966, would also allow for easier training of new recruits. While it has certainly had its teething pains, partly due to being rushed into service, it did go on to prove itself as one of the world's most respected assault rifles, now in predominantly M4A1 Carbine form. I am here today to focus on a battle rifle, but first just a bit of assault rifle history. The German FG42 of World War Two was the first real attempt to combine battle rifle and sub-gun characteristics for paratroopers. Its 8mm Mauser cartridge was rather hard to manage in auto fire mode, even with its muzzle brake.

Slide (5) Evolution toward the Assault

We can look back to WWI to see the beginning attempts to optimize a mix of small arms on the battlefield. The first two submachine gun designs were into European service by 1918 as was the M1918 Browning Automatic Rifle over here. The US would enter the Second World War with a fine mix of long arms including the Thompson Sub-Machinegun, M1 Carbine, M1 Garand, and M1918A2 BAR along with the belt fed 1919 Browning series. By late in that war the Germans had fielded an optimal cartridge to cover a full 300 yards of ground in a Sub-gun turned Assault Rifle the Stg 44.

Slide (6) Details of Winning Battles

While not a lightweight, the Stg 44 shot flatter and packed more punch than a Thompson, M1 Carbine or Russian PPSh-41. The M1 Carbine had been meant more for a defensive role and served well as a handy pistol substitute with reasonable performance to 200 yards, with a claimed effective range of 300 yards as defined by a remaining bullet energy of 250 ft-lbs. After World War 2, firepower

became the focus. Studies had shown that volume of fire alone was primarily responsible for inflicting casualties, and also that engagements generally occurred at the closer ranges, negating the long range performance benefits of main battle rifles. While this theory seemed to prove itself in Vietnam with an estimated 200,000 rounds per kill, the recent application of magnified optics to primary weapons can often double typical effective engagement ranges from 300 yards to 600 yards allowing for improved results for aimed fire. Back to the M14.

Slide (7) with M79 M14 & M16 pic DARPA symbol

The reasons the M14 did not last long as a primary issue weapon are "complicated" to say the least. While it was declared standard issue by May of 1957, there were only just over 133 thousand in existence by summer of 1961. The excellent M79 Grenade Launcher had been introduced by that same year so the M14's use as a grenade launcher was already being superseded. The first quantity AR-15 purchase was being approved by 1962. ARPA, today known as DARPA the Defense Advanced Research Projects Agency had been authorized to buy 1000 AR-15 rifles in late 1961 after limited testing of 10 Colt rifles. At that time it was the M2 Carbine being compared to the AR-15 to determine the most suitable weapon for a Vietnamese soldier. Also in 1962, just as M14 production was getting into full swing the AR-15 supporters were touting it as the do-all weapon, even for US troops. At the same time however, the SPIW – Special Purpose Individual Weapon was supposedly on track to be replacing them both by 1965. SPIW concepts no doubt spurred development of the effective M203 grenade launcher - in service from the early 1970s on through today.

Slide (8) Showing SPIWs

So, with around a million M14s in existence by 1963, production was cancelled – all production had ceased by July of 1964. Money was redirected toward a one time buy of the newly popular AR-15 for special mission units and soon – so it was thought - the SPIW would be replacing both weapons. We all know the SPIW never made it to prime time – doomed by its own specifications - and admittedly I have digressed. As long as I am off topic - another interesting note is the small caliber high velocity program dating back to 1952 where M1 carbine variants were firing 41 grain slugs at over 3000 feet per second based on a 300 yard range requirement. By 1957, range had been expanded along with the cartridge. This sort of cartridge might have been very useful from Vietnam on through today. We return again to the M14.

Slide (9) Viet Nam and onward M14 Versions

The M14 in standard battle dress as well as in sniper trim with its 3-9 power Leatherwood/Redfield ART – Adjustable Ranging Telescope, which often included a Sionics M14SS-1 Sound Suppressor, served their purposes well in Southeast Asia. The AN/PVS-2 Starlight scope also got used on the Sniper versions for night operations. While the rifle had immediately been adapted for match and sniper use once it was available, the sniper format was not officially known as the M21 until 1972. The action itself was not intended for removal from the stock by the user. The M14 when epoxy or "glass" bedded to a heavy stock went on to become an excellent match rifle and had constant use as a sniper or sharp shooter weapon from Viet Nam on through today as seen in the USMC Designated Marksman Rifle or DMR fielded since 1998.

Slide (10) Updated M14 Sniper Rifle Pictures w/ M24 and DMR M40A1.

The M21 remained the Army's official sniper rifle until its replacement by the bolt action Remington M24 in 1988. The Marines had introduced the first M40 bolt action Sniper Rifles by 1966. The Navy had been using McMillan and Remington based bolt action 7.62mm rifles along with M14 variants throughout the 1980's and 90's for sniper applications. The Army's 10th Special Forces retained M14s in a modernized sniper format as the M25 – originally called XM25. They attempted to overcome bedding and scope mount shortcomings of the old M21 with this system which used a steel Brookfield Scope Mount as did the Navy Port Security Rifles of the time. In April of 1992, I had the opportunity to see the XM stage of this system up close. I visited West Brookfield Massachusetts where Mitch Mateiko of Brookfield Precision Tool and one of the developers Tom Kapp who had been a Master Sergeant with the 10th Special Forces Group, then stationed at nearby Ft. Devons, schooled me in the installation of a unique steel stock liner which was intended to allow for removal of the barreled action without fear of bedding damage or loss of zero which was a concern with bedded rifles. It served the same purpose as the M24 stock's integral aluminum liner. I also tried out the OPS Inc. Sound Suppressor used with that system to include an associated gas piston with a reduced gas inlet hole diameter and Titanium Nitride coating. Brookfield Precision also made an AN/PVS-4 night sight mount which 10th group had used successfully on the XM-25 during Desert Storm.

Slide (11) Shows M14 SSR MK 11 and SCAR Heavy and SASS

A specially inletted McMillan Fiberglass stock was used for the XM-25. While only 2 Navy rifles were ever configured with the liner, I always liked the concept as

well as that of a rear pistol grip such as used on the original M14A1 stock. This feature was included on one of the McMillan stocks I used for this liner experiment. I was also working with variable power optics with mil-dot reticles in the first focal plane at the time – I liked that concept as well, especially for use with the clip-on night sight of the day – the Simrad KN200. Several years ago M14 sniper rifles were replaced in Naval Special Warfare inventory by the MK 11 MOD 0 version of the SR-25, which itself is scheduled for future replacement by the SOF Combat Assault Rifle or SCAR Heavy – MK 17 Sniper Support Rifle variant. The Army is also beginning fielding of the SR-25 based SASS or Semi-Automatic Sniper System designated as the M110. As available it will likely replace many scoped M14s as well as M24's.

Slide (12) Recent Navy M14 Use (with MK 14 Navy / Ship use of M14)

The Navy has continued to use M14s in the fleet where they excel at tossing lines between ships, besides providing full battle rifle performance. They have however, been replaced on many defensive watches by the lighter and easier trained M16 series. Navy EOD has been using M14s and MK 14s for counter mine or SMUD – Stand-off Munitions Disruption tasks as well. The M14 has also of course remained in use scattered among the SEAL teams in sniper and battle rifle forms for nearly 50 years now - with the latest configuration being the MK 14.

Slide (13) Recent Army M14 Use (Iraq)

The popularity of assigning at least one good shooter in a squad to Designated Marksman type duties has grown over the last 20 years. The same basic concept was also used by the U.S. in World War 2. A semi-automatic action allowing for multiple, rapid follow-up shots works best for this sharpshooter type role. The utility is apparent for an accurate, variable power scope equipped, semi-automatic rifle, firing full power battle cartridges in modern combat environments. While many combat tasks are well done with a modern 5.56mm Carbine, there are plenty of jobs left for its heftier cousin. The Navy has continued to issue the last Sniper Security Rifle version of the M14 for these sorts of applications up through today. An Army Infantry Division even had a contractor overhaul a number of their M14's for DM type duties to include a sound suppressor.

Slide (14) Shows M14 muzzle devices to include the original Army M14A1 unit

Before I focus on the most current forms of the M14 I will digress once again to one of my first projects for the Navy at Crane in the late 1980's. It was a slip-on M14 muzzle compensator. My boss at the time had done the initial design, which

was great at reducing recoil but failed in keeping the muzzle down. I modified and completed the design to achieve fairly impressive full-auto performance before producing about 35 units. These were distributed along with a simple questionnaire in the hopes of getting plenty of feedback from users. I soon found out paperwork is not especially a SEAL thing, though I did get a well written and positive response from SEAL Team 3. While we never got funded for production, this project did give me plenty of M14 trigger time. I also proved to myself that the M14 can be more useful in full-auto mode than most folks might realize. A 3 round burst on a kneeling man "E" target at 25 yards was not a problem. I also believe an HK 50 round drum adapted for M14 use, could be very interesting. I did of course use genuine M14A1 compensator attaching bails for these devices until while available and then switched to imitations.

Slide (15) Shows the various attempts at the Arctic M14 stock

The Navy's MK 14 MOD 0 and recently MOD 1 evolved out of a hybrid M14 originally developed by NSWC Crane for Arctic Warfare around the year 2000, with the primary goals of a telescoping stock and shortened barrel. An initial user assessment of several prototype stock configurations followed, to include a lone folder. The stock most interesting to the users who evaluated them was one I had fabricated from a Sage International Telescoping 870 Shotgun Buttstock and GI fiberglass M14 stock. I included a photo of one of these early versions shown in the last brief I gave to this audience in 2002. A quantity of issue fiberglass stocks was modified with this Sage butt-stock configuration based on operator feedback and issued for use with the full length 22 inch barreled M14. Two experimental M14 prototypes were also made with 18 inch heavy barrels and custom scope rails. They were fitted with a prototype .30 caliber version of the same QD Sound Suppressor in use then and now on the M4A1 Carbine.

Slide (16) Shows early test versions of the EBR stock and barrels.

We had a design for a complete stock chassis by the summer of 2002 and prototypes were machined from aluminum alloy by Sage International. A highly modified form of the original telescoping shotgun butt-stock was attached. 16 and 18 inch barrel configurations were tested and the 18 inch barrel length was established – 4 inches shorter than the original 22 inch length. The front sight was later moved to the gas cylinder lock and a simplified screw-on flash suppressor was added. The stock included a top Mil Std 1913 rail to support a front scope ring and forward mounted night vision devices, while a rear rail section replaced the original stripper clip guide to support a rear scope ring. This scope mounting concept had originated with the early Knight's Armament M14 rail system which had been

experimented with briefly. Barrel twist used was 1 turn in 11 inches. While the full length lower rail was thought of as a possible support for a rail mounted M203 or other future Grenade Launcher, practically speaking the M14 EBR itself was front heavy enough. Then there is the ¾ pound per shot 40mm ammunition to consider. Though, I must say - the look is rather more appealing than that of those SPIWs we saw earlier.

Slide (17) EBR concepts feature examples

A rundown of the key features planned for the EBR include: Large aperture rear sight, ring and post front sight mounted to a replacement gas cylinder lock - originally tested as a single “triple ring” unit, M16 type tactical bolt release - which by the way, had been considered for use on the original M14, improved - simple screw-on flash suppressor, and the aluminum chassis stock system. This stock floats the gas system through a replacement operating rod guide screwed to the rigid stock forend and a simple spacer replacing the front band. The stock also included ambidextrous sling points and adjustable length as well as cheek-rest height - which has long been an issue for optic equipped M14s. An 18 inch commercial barrel was included as was a short bipod, 3 point sling and scope mounting capability. Sound Suppression was also considered.

Slide (18) EBR test configurations

Several prototype Night Vision mounts for Litton M983 type PVS-18 pocket scopes as well as the AN/PVS-17 Mini Night Vision Sight were designed and produced in house for evaluation. See through type rings were commissioned as were specially marked elevation knobs for use on a 1.5 to 5 power optic with illuminated circle-dot reticle. The knob was calibrated from 100 to 600 yards for both M118LR and M80 ball ammunition. The MK 14 MOD 0 was issued with the see through rings but no optics or sound suppressor due to funding limits. There was hope that users could locate a suitable optic at their commands and the flash suppressor design would support attachment of possible future sound suppressors.

Slide (19) MK 14 MOD 0

A series of tests and tweaks finally resulted in the MK 14 MOD 0. It is able to group at 12.5 to 15.7 inches or 2 to 2.5 MOA for a 5 shot Extreme Spread at 600 yards with M118LR ammunition and nearly as well with M80 ball. The chassis stock allows for this accuracy by its close-fit receiver interface and by supporting the barrel through its replacement operating rod guide. Simply adding a chassis stock system can cut the group size of a basic issue M14 in half without the need for

“glass” bedding. The use of a simple screw-on flash suppressor also helps reduce risk of accuracy issues as compared to the complex mounting design of the standard unit. The stock forend was also shortened about an inch and a half to reduce weight. This was accomplished on prototypes by cutting a section of forend out and welding it back together. Having been the SODMOD Kit project engineer, I naturally called them ChopMods. There is also a screw at the front of the top rail - allowing for barrel contact/preloading downward if desired to tune for optimal accuracy - achieving a similar effect to that from front band pressure on a glass bedded action. This preload screw is not employed during acceptance testing.

Slide (20) Pictures of the MK14 racks and SEI and SureFire Suppressed w/optics.

The MOD 1 will support use in the DMR type role as issued since it includes a variable power optic on a quick detach rail as well as sound suppression capability and match conditioned trigger. The optic is primarily a 2.5 to 10 power Nightforce NXS. The Auto Selector has also been removed. While the MK 14s are certainly accurate for battle rifles, their 2 to 2.5 MOA average extreme spread is not quite up to true sniper accuracy. They are acceptance tested at 100 yards allowing for up to a 1.1 inch Mean Radius 5 shot group using M118LR ammunition. They generally beat that criteria by a quarter inch on average. There is however, interest in looking at match grade barrels for the best possible accuracy to maximize range to the cartridge’s full 1000 yard potential. Other tuning may also be considered such as additional gas cylinder fitting and round operating rod spring guides.

Slide (21) MK 14 MOD 0 and MOD 1 (tool and wt. comparison)

While the latest version of the MK 14 – the MOD 1 does not get quite as short as the MOD 0 it is over 3/4 of a pound lighter in basic form. The MOD 1 also offers three storage areas not available on the MOD 0. One is in what looks like a buffer tube requiring removal of the buttstock and threaded end cap for access, and the others are in both the front and rear pistol grips. The M14 has never been a lightweight, coming in well over the original 1945 lightweight rifle goal of 7 pounds - without accessories - for a full-auto capable battle rifle. Even the MK17 SCAR Heavy with standard 16 inch barrel still exceeds that goal by near a pound. The MK 14 configurations, while heavier still, do allow for use of day and night optics along with SOPMOD kit type accessories to keep this old war horse viable in any of today’s wide ranging engagement scenarios.

Slide (22) MK 14 (MOD 0 and MOD 1) vs. M4 Carbine size

The MOD 0 with 18 inch barrel and collapsed stock is nearly as portable as the 14.5 inch barreled M4 Carbine at only 4 and 1/2 inches longer, yet it retains full battle rifle performance in a package 9.4 inches shorter than the standard 44.4 inch long M14. The chassis stock system of the MK 14 can be added to any standard M14 rifle by simple replacement of the operating rod guide and the front band at the unit level. The chassis stock overcomes previous accuracy issues through stock fit combined with operating rod and barrel support. Reportedly over 2000 Sage stocks have been sold directly to military individuals and units - greatly improving the utility of many - Army provided - M14s.

Slide (23) pictures showing soldiers with EBR stocked M14s

Whether deployed on open expanses of Afghanistan or the city streets of Iraq, a clear division of purpose comes into play for the individual soldier's primary weapon. In areas with 200 to 300 yard maximum possible engagement ranges, compact size followed by light weight and quick acquisition sights, are key for most members of a unit. However, there are plenty of scenarios even in urban areas where a squad's best shooters may serve the unit most effectively if they carry a full power battle rifle configured for use by a "designated marksman" or "sharp shooter" of sorts.

Slide (24) more pictures of Military M14 EBR conversions

The more versatile that battle rifle is, the more easily it can fit a range of mission profiles. Thus, the Enhanced Battle Rifle or EBR for short. Enhancements include provision of plenty of Mil Std 1913 rails for accessory attachment, allowance for adjustment where possible for improved ergonomics, and reduced length for transit and body armor use as well as operation in confined spaces, such as for building clearing. Some sort of optical sight mounting capability is also critical in today's battle space.

Slide (25) recent M14 dev. Troy (Rock) / JAE 100, other rails, McMillan

There has been a fair amount of interest in supporting the M14 and especially its civilized cousin the M1A in recent years. The design has always been tough to beat for reliability, but required laborsome "bedding" and "tuning" for best accuracy. Now with the various stocks, rails, and accessories available, this rifle family can be tailored to remain a practical and cost effective choice for the Military, Law Enforcement and Serious Plinkers alike. Hopefully the versatile and modular

barreled SCAR Heavy series will prove a worthy replacement for use by Special Operations Forces.

Slide (26) with both SOPMOD posters.

As the former project engineer for the USSOCOM sponsored SOPMOD accessory Kit – I worked all items seen in these posters to include the AN/PVS-17 Mini Night Vision Sight. So, I am well aware of the trend toward shorter and lighter weapons and the benefits of compact size along with the ability to attach useful accessories to a weapon. Downsizing as well as accessorizing can be taken too far though, especially if the cartridge itself is not downsized and loaded to work best with the shorter barrel. The very first accessory we added to the M4A1 was an optic - the 4 power Trijicon ACOG which makes that weapon very dangerous within 500 to 600 yards.

Slide (27) includes MARS and KAC PDW and 10 inch MK18 (& SCAR)

I believe the recent Knights Armament PDW entry with its 6X35mm cartridge as well as the earlier MARS – Mini Assault Rifle System concept developed by LTC retired Mike Harris in 5.56X30mm are both on the right track for an optimized individual weapon for the closer ranges out to a 300 meter maximum. They should equal the performance of the 10 to 11 inch barreled M4 carbines and new MK16 SCAR Light CQB variants without the extra blast and recoil and with lighter ammunition and weapons, yet they pack much more punch than the Personal Defense Weapons in 4.6X30mm or 5.7X28mm, so can be useful in both defensive and offensive scenarios.

Slide (28) Show slide from my UK brief comparing weights of ammo - optimization.

In choosing a mix of weapons for a typical military squad today, leaders need to take into account a variety of factors, one of which could be called “stowed hits” a fancy statistical term for ammunition carried or at least some percentage of it. As can be seen in this slide I extracted from a talk I gave at the 2002 European Small Arms Symposium in England, the trade-offs of range vs. firepower need to be considered when choosing a primary weapon.

Slide (29) Ammo Load Optimization – measured by Combat Time

The effectiveness of the weight carried is increased by the number of effective rounds per pound so to speak. The possible engagement conditions need to be anticipated to achieve a proper weapons mix for a unit. As a simple example this slide shows how planning around an ambush might influence weapon selections within a squad.

Slide (30) Target Availability Distribution Slide - OICW study engagement ranges

Engagement scenarios and threat weapons must be kept in perspective, leading to an optimal mix of available small arms and other weaponry within any fighting unit. The intermediate cartridges have their place, as do full-power battle cartridges such as the 7.62mm NATO, especially in the hands of well trained marksmen wielding scoped MK 14 Enhanced Battle Rifles or other suitably chambered and optically equipped weapons of equal or better accuracy. The modernized M14 remains a strong bench mark for comparison to newer and lighter rivals such as the MK 17 SCAR Heavy and HK 417. Select members of a unit may not need to pack along fire superiority based quantities of ammunition if they can make the majority of their shots fired mean something significant downrange.

Slide (31) Final Slide with M14 and MK 14 MOD 0 (evolution beginning /"end")